North on Cary Street to Middle Street and Marrett Road (Rte. 2A)

2

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Figure 2. 17

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Figure 2. 18

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Figure 2. 19

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Figure 2.20

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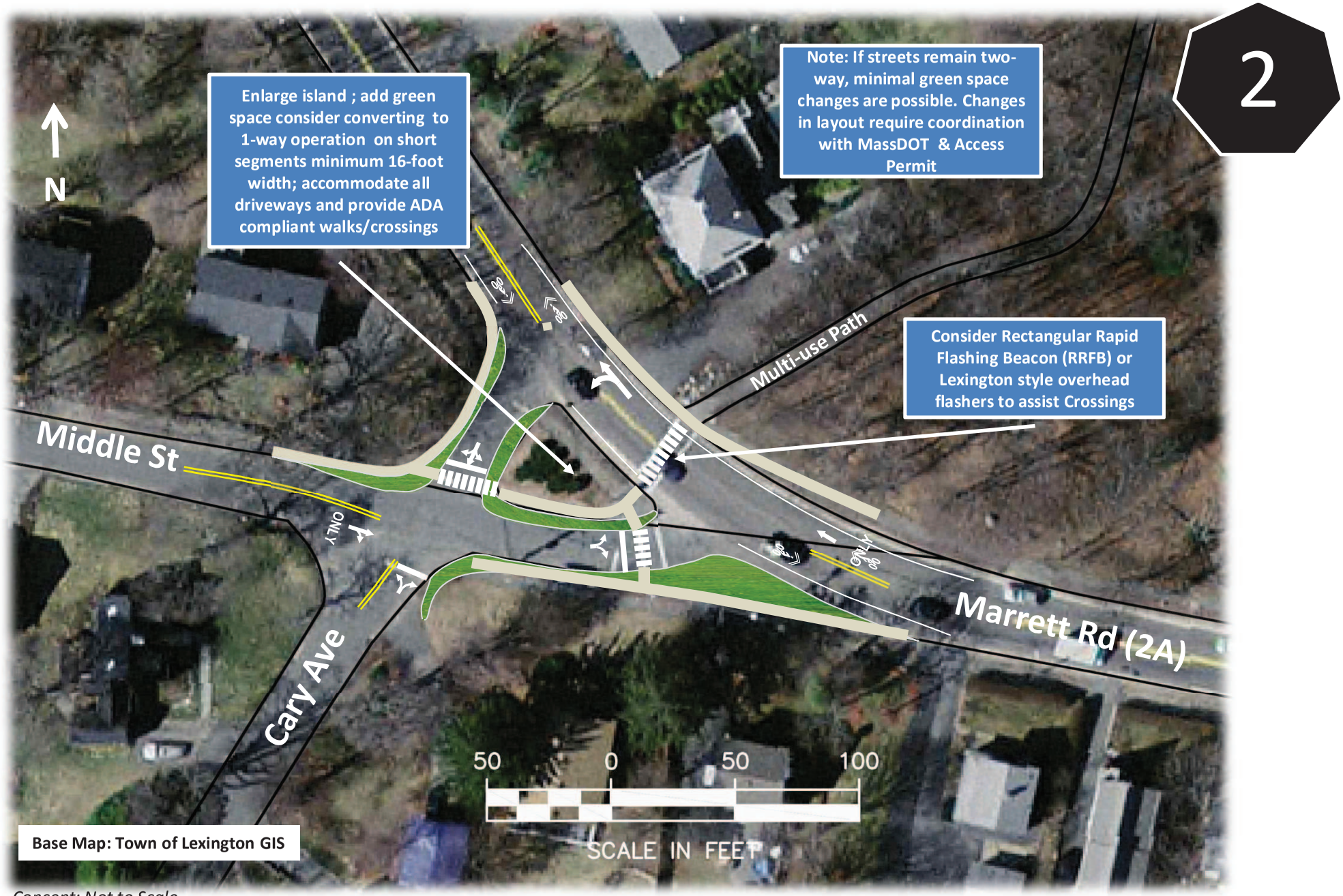
Figure 2.21



Concept: Not to Scale

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Figure 2.22 - Marrett Road (Route 2A) at Cary Avenue and Middle Street
Option 1 - Enlarge Island and Modify Circulation

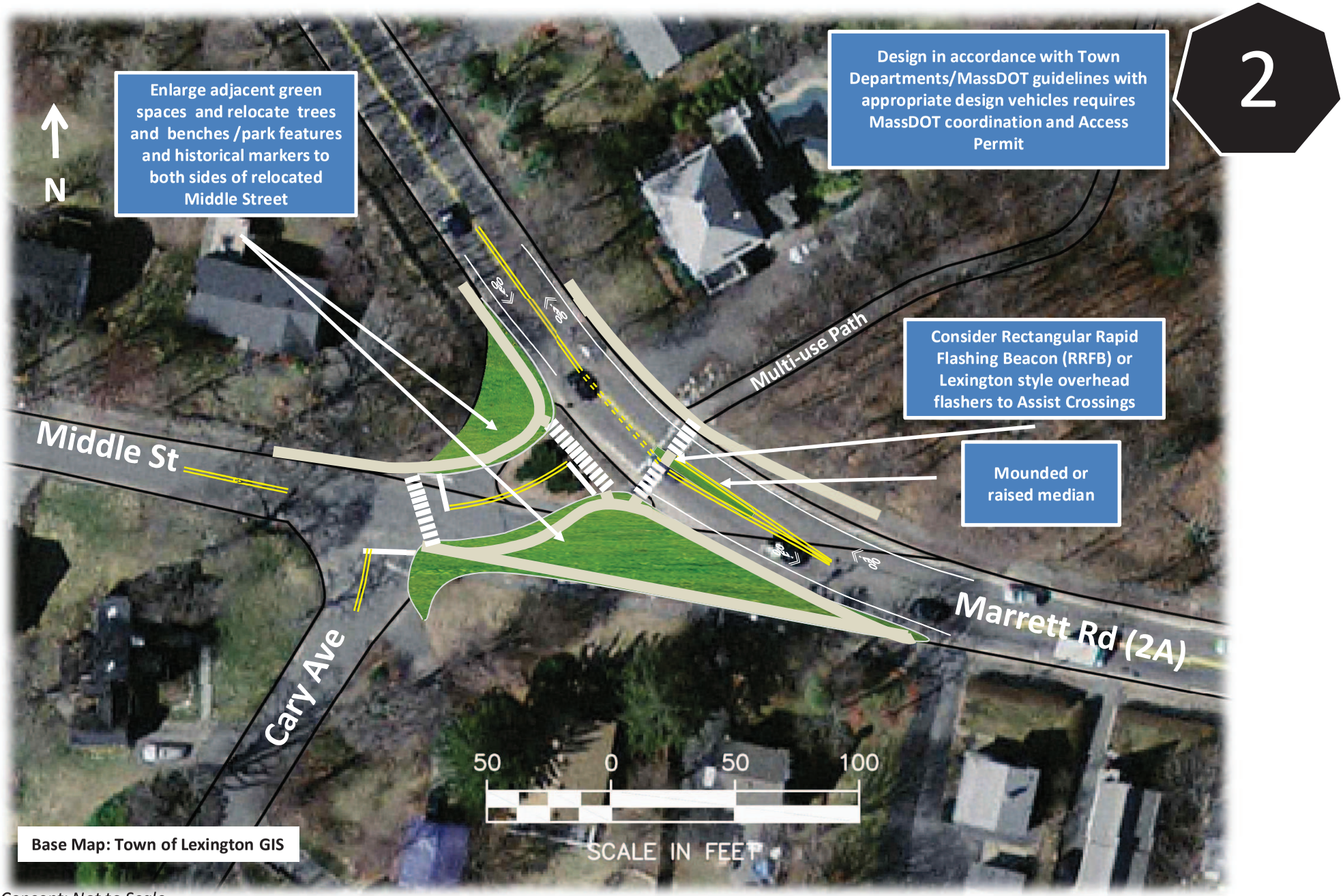

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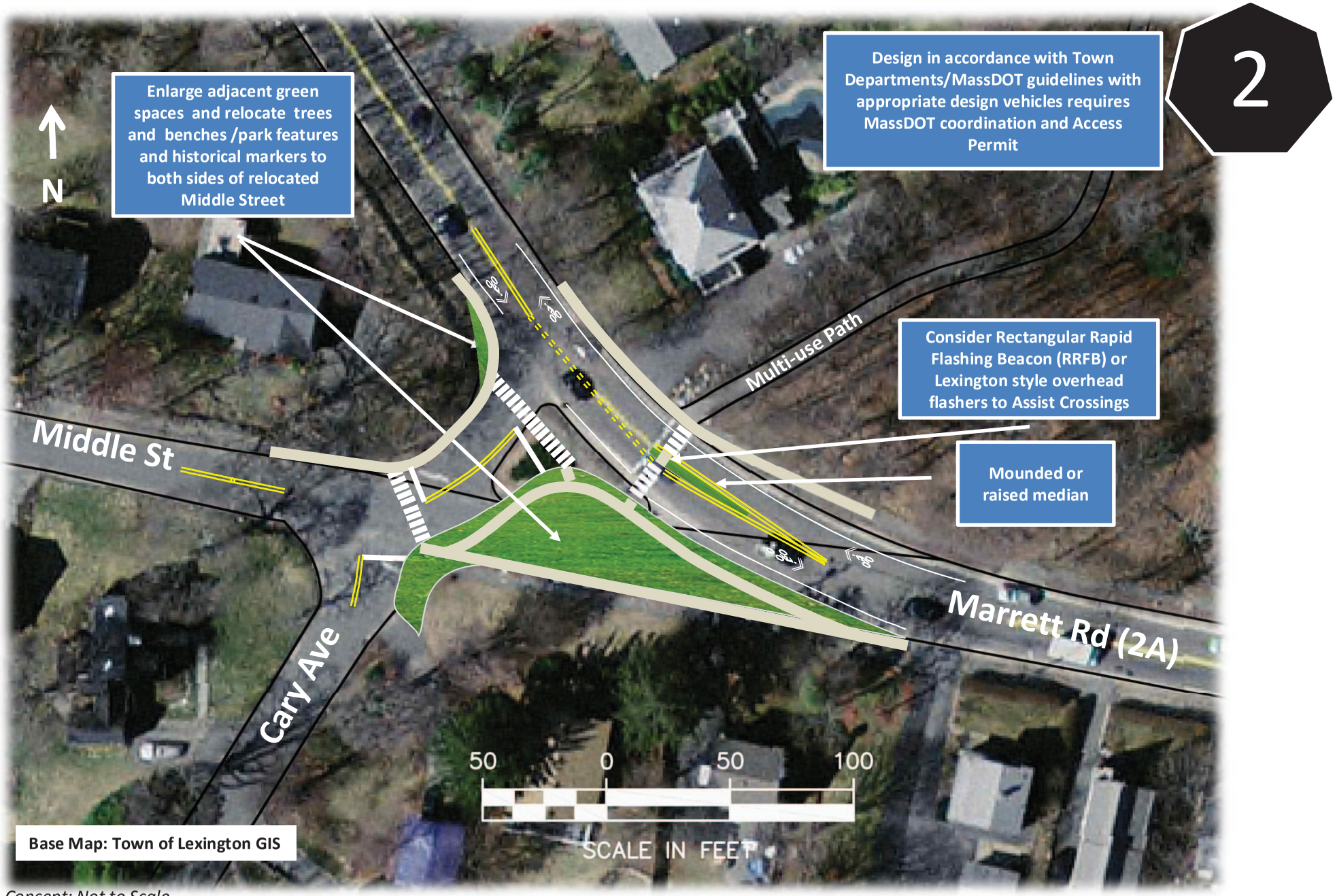
Figure 2.23 - Marrett Road (Route 2A) at Cary Avenue and Middle Street
Option 2 - Simplified Circulation with Median



Concept: Not to Scale

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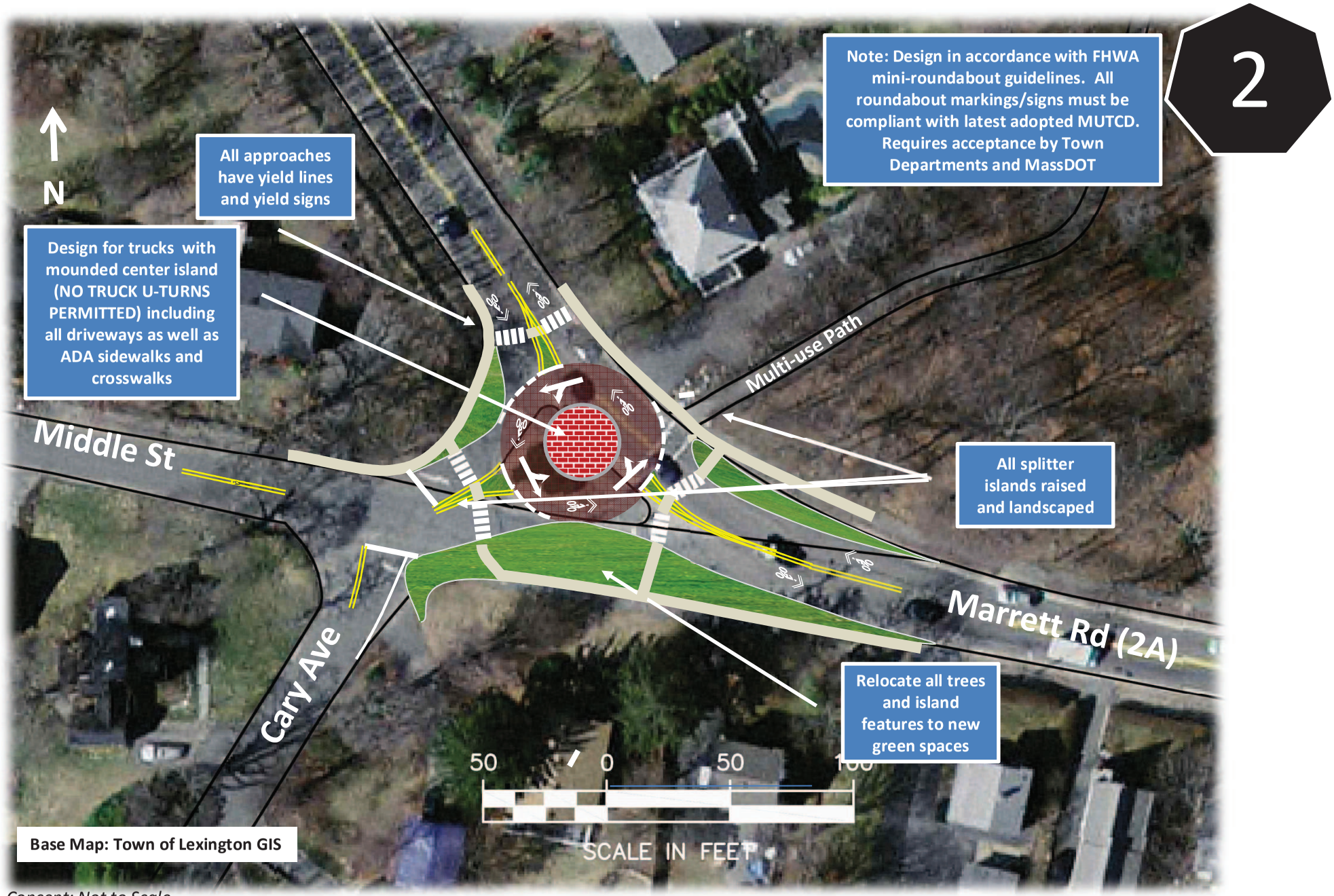
Figure 2.24 - Marrett Road (Rte.2A) at Cary Avenue and Middle Street
Option 2A - Simplified Circulation with Median



Concept: Not to Scale

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Figure 2.25 - Marrett Road (Route 2A) at Cary Avenue and Middle Street
Option 3 – Mini-roundabout

2.3.2 Area 2 - Marrett Road (Route 2A) at Cary Avenue and Middle Street (Continued)

Left turns from Marrett Road would occur at Cary Avenue allowing better visibility of oncoming traffic.

The southbound Cary Avenue approach to the Middle Street sight line looking to the right would improve. All left and right turns from Cary and Middle Streets would be made at a modified Middle Street approach to Marrett Road. Consider a Rectangular Rapid Flashing Beacon (RRFB) for the Marrett Road crosswalk at the multi-use Path and skip-dashing the double yellow centerline on Marrett Road across Middle Street to make it clear that Marrett Road is the main route of travel.

Option 1 benefits:

- Enhances Marrett Road safety compared to "Do Nothing" option
- Generally enhances pedestrian/bike environment & clarifies Marrett Road edge at Middle Street
- Adds green space
- Improves Cary Avenue at Middle Street sight line
- Overall peak hour operations remain LOS C or better

Option 1 drawbacks:

- Estimated costs, $100,000 - $150,000
- Slightly increases pedestrian/vehicle conflicts at multi-use path
- While improving the existing Middle Street skew at Marrett Road, it is still less than 90° (preferred)
- Slight concern with rear-end collisions with northbound Marrett Road left to Cary Avenue

Option 2 – Simplified circulation with median

Refer to Figure 2.23 for an overview sketch of Option 2. The island between Cary Avenue and Middle Streets would disappear, with larger adjacent green spaces. The two Cary Avenue and Middle street approaches would be replaced by a single intersection, assumed the continuation of Middle Street, where all movements would occur. Marrett Road would have a new 6-foot median at the multi-use path crossing. The RRFB proposed under Option 1 would be an option.

Option 2 benefits:

- Enhances Marrett Road safety compared to "Do Nothing" option
- Removes one intersection
- Enhances the pedestrian/bike environment & clarifies Marrett Road edge at Middle Street better than Option 1
- Adds net green space

- Improves Cary Avenue/Middle Street sight lines/eliminates skew angle
- May reduce the attractiveness of Cary Avenue as a cut-through
- Overall peak hour operations remain LOS C or better

Option 2 drawbacks:

- Estimated higher costs than Option 1, $150,000 - $250,000
- Slightly increases pedestrian/vehicle conflicts at multi-use path
- Park impacts (requires relocation of all park amenities)

Option 2A – Simplified circulation closer to Cary Avenue with Median

Refer to Figure 2.24 for an overview sketch of Option 2. The island between Cary Avenue and Middle Streets would still disappear, with a larger adjacent green space, located primarily east of the existing short leg of Cary Avenue. The two Cary Avenue and Middle Street approaches would be replaced by a single approach, assumed the continuation where all movements would occur. Marrett Road would have a new 6-foot median at the multi-use path crossing. The RRFB proposed under Options 1 and 2 should remain.

Option 2A benefits:

- Enhances Marrett Road safety compared to "Do Nothing" option
- Removes one intersection
- Enhances the pedestrian/bike environment & clarifies Marrett Road edge at Middle Street better than Option 1
- Preserves more of the existing island than Option 2
- Adds net green space
- Improves Cary Avenue /Middle Street sight lines/eliminates skew
- Overall peak hour operations remain LOS C or better

Option 2A drawbacks:

- Likely higher costs than Option 1, $150,000 - $250,000, but slightly lower than Option 2
- Slightly increases pedestrian/vehicle conflicts at multi-use path
- Park impacts (requires relocation of most park amenities on the island)
- Reduced visibility of left turning motorists for following westbound Marrett Road traffic.

Option 3 – Mini-roundabout

Refer to Figure 2.25 for an overview sketch of Option 2. The island between Cary Avenue and Middle Streets would disappear, with larger adjacent green spaces. The two Cary Avenue and Middle street approaches would be replaced by a single intersection, assumed the continuation of Middle Street, where all movements would occur. Marrett

Road would have a new 6-foot median at the multi-use path crossing. The RRFB proposed under Option 1 would be an option.

Option 3 benefits:

- Roundabouts are a top-ten USDOT crash reduction measure
- Removes one intersection
- More green space than existing, but located on roadside rather than concentrated in an island
- Overall peak hour operations remain LOS C or better

Option 3 drawbacks:

- Estimated costs of $200,000 - $250,000
- Slight offset at multi-use path
- Smaller radius mini-roundabout requires mountable center island for trucks
- Park impacts (requires relocation of all park amenities to newly created green spaces)
- Requires all traffic to slow entering intersection
- May not be suitable on an arterial (MassDOT would need to approve) to maximize its attractiveness for through traffic

2.3.3 Area 3 - Route 2 Westbound off-ramps to Waltham Street and Hayden Avenue

During the past couple of years several improvements have been made to Hayden Avenue in the vicinity of the WB Route 2 off-ramps. It is understood that the Town also briefly reviewed conceptual options at this interchange, so strategies evaluated in this report are conceptual only. Figures 2.26-2.30 are photos of the existing interchange area, while three potential strategies for addressing observed issues are illustrated on Figures 2.31-2.33. The three options evaluated include:

Option 1 – Provide Bike Enhancements, Signalize & Modify Route 2 WB Ramps at Waltham Street with Single Controller

Refer ahead to Figure 2.31 for an overview sketch of Option 1. Basically this alternative would reconfigure the interchange and signalize three intersections coordinated with one controller. It would permit traffic on the westbound off-ramp to make either a left or right off the interchange onto Waltham Street, provide bike lanes through the interchange and signalize the left turn movement to Hayden Avenue (the right turn onto Hayden Avenue would be eliminated). It would allow traffic coming from Route 2 to make an easier weave across northbound Waltham Street traffic to turn left onto Hayden Avenue under a controlled condition. It would also allow Route 2 westbound traffic to turn left under positive control, rather than at a stop sign.

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Figure 2.26

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Figure 2.27

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Figure 2.29

North on Route 2 WB off-ramp left to Hayden Avenue

3

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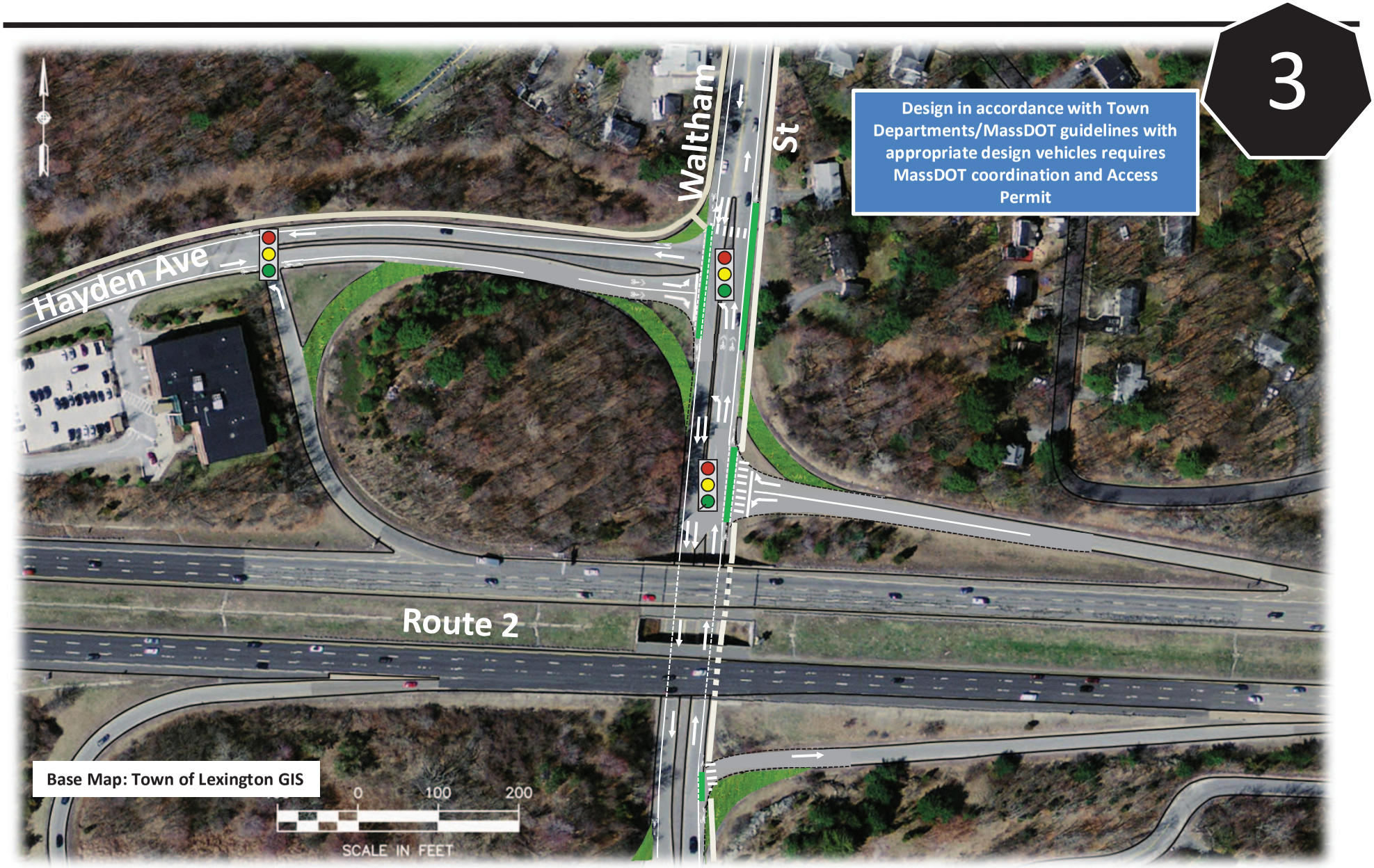
Figure 2.30



Concept: Not to Scale

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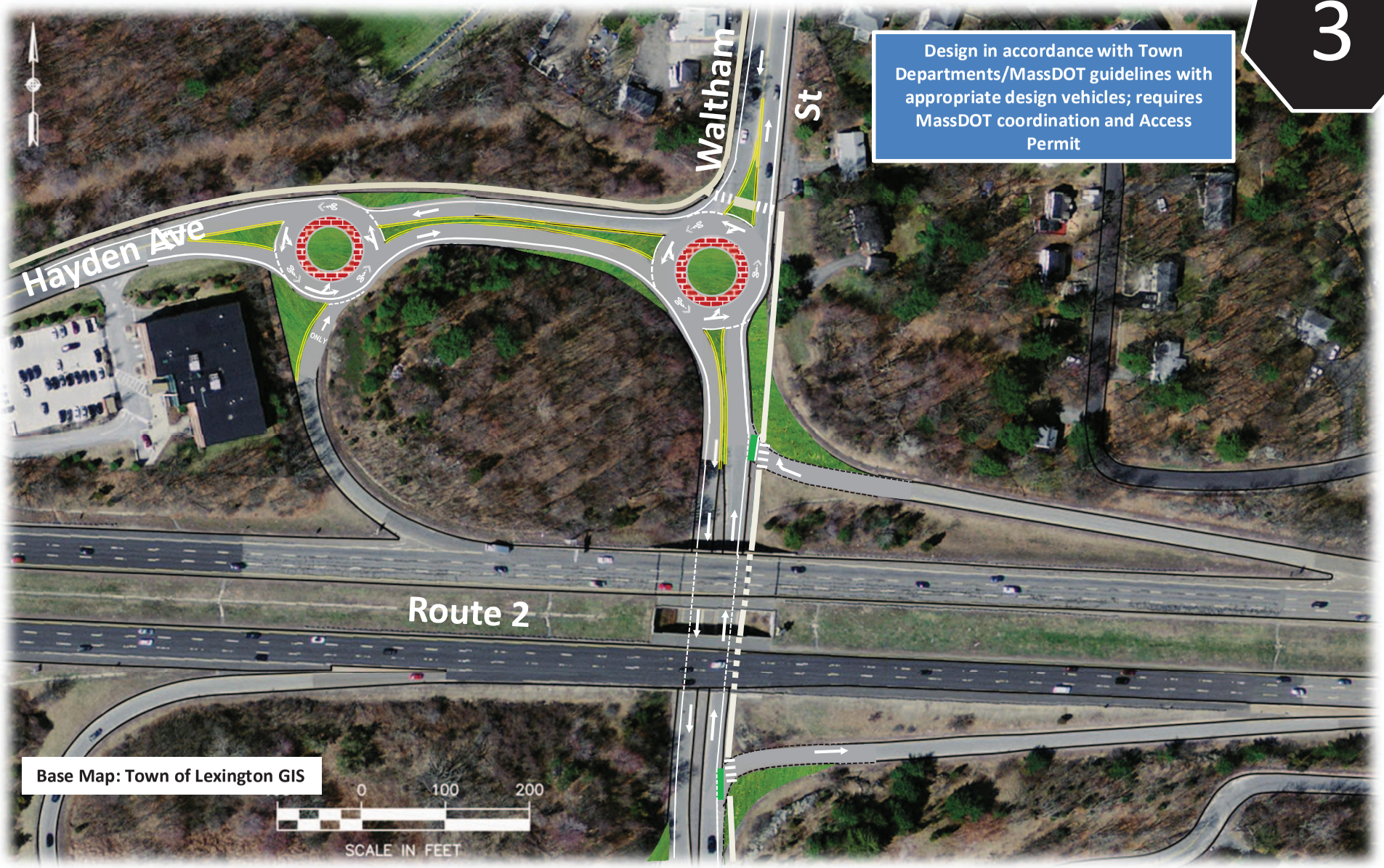
Figure 2.31 – Waltham Street at Hayden Avenue and Route 2 Ramps

Option 1 Provide Bike Enhancements

Signalize & Modify Route 2 WB Ramps at Waltham Street with Single Controller



Concept: Not to Scale

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Figure 2.32 — Waltham Street at Hayden Avenue and Route 2 Ramps
Option 2 – Provide Bike Enhancements
Create Dual Roundabouts of 2 WB Ramps at Waltham Street

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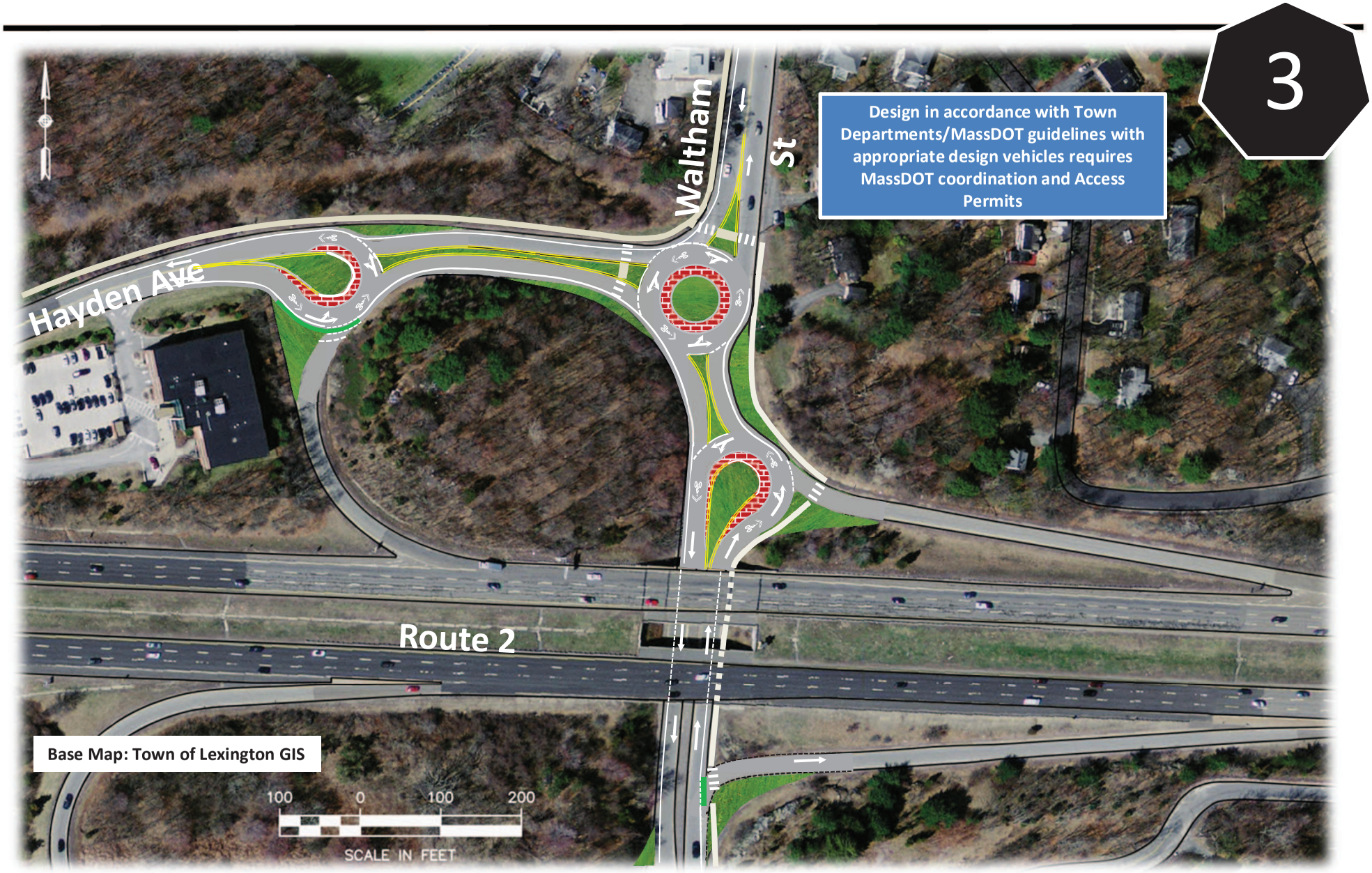

Concept: Not to Scale

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Figure 2.33 — Waltham Street at Hayden Avenue and Route 2 Ramps
Option 3 – Provide bike enhancements
Create Two Partial and one Full Roundabout at Interchange

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2.3.3 Area 3 - Route 2 Westbound off-ramps to Waltham Street and Hayden Avenue (Continued)

Option 1 – Signalize three intersections controlled by a single controller and Enhance Pedestrian/Bike Circulation (Continued)

Option 1 benefits:

- Enhances safety compared to 'Do-Nothing' option.
- Generally enhances pedestrian/bike environment through the Route 2/Waltham Street interchange.
- Reduces length and speeds on Waltham Street and reduces bike conflict zones
- Adds green space/bike lanes
- Overall peak hour operations would be LOS D or better

Option1 drawbacks:

- High costs exceeding $1-$1.5 million to implement
- Long term signal maintenance costs
- Signals may increase rear end collisions
- Requires two lanes southbound on Waltham Street and would convert the exclusive right lane to Hayden Avenue to a shared through/right lane
- Requires a lane drop south of the newly configured interchange

Option 2 – Convert two intersections into modern roundabouts with approaching bike lanes.

Refer back to Figure 2.32 for an overview sketch of Option 2. This alternative would reconfigure the interchange and convert the two of the intersections coordinated into modern roundabouts designed to accommodate all allowable turning movements. Roundabouts would permit traffic on the westbound off ramp to make right turns to accommodate all traffic movements and would eliminate much pavement in the interchange. We assume bike lanes would be provided within the interchange, similar to Option 1 south of the Route 2 WB off ramp. At the roundabouts, bikes would either merge with reduced speed vehicle traffic or cross at the pedestrian crossings. Option 2 would eliminate the need for traffic coming from Route 2 to weave across northbound Waltham Street traffic to turn left onto Hayden Avenue. It would also slow traffic flow through the interchange, thereby benefitting pedestrian and bike movements.

Option 2 benefits:

- Enhances safety compared to 'Do-Nothing' option
- Generally enhances pedestrian/bike environment through the Route 2/Waltham Street interchange area.

- Reduces length and speeds on Waltham Street and reduces bike conflict zones
- Overall peak hour operations would be better than existing, but LOS E for some roundabout movements
- Adds green space/bike lanes

Option 2 drawbacks:

- High costs exceeding $1-$1.5 million to implement
- Requires Waltham and Hayden Avenue traffic using the interchange to slow down below
- Waltham Street at Hayden Avenue roundabout may need partial multi-lane treatment to operate without congestion during the AM peak hour

Option 3 – Provide bike enhancements; create two partial roundabouts and one full roundabout at interchange

Refer to Figure 2.33 for an overview sketch of Option 3. This alternative would reconfigure the interchange and convert the two of the intersections into partial roundabouts designed to accommodate all allowable turning movements under yield control. The partial roundabout would permit traffic on the westbound off ramp to travel both north and south on Waltham Street to provide redundancy to the westbound off ramp to Hayden Avenue that would serve all traffic movements. It would eliminate much pavement in the interchange. It assumes bike lanes will be provided through the interchange, similar to Option 1 south of the Route 2 WB off ramp. It would eliminate the need for traffic coming from Route 2 to weave across northbound Waltham Street traffic to turn left onto Hayden Avenue. It would also allow traffic to operate slower through the interchange, thereby benefitting pedestrian and bike movements.

Option 3 benefits:

- Enhances safety compared to 'Do-Nothing' option
- Generally enhances pedestrian/bike environment through the Route 2/Waltham Street interchange area.
- Reduces length and speeds on Waltham Street and reduces bike conflict zones
- Overall peak hour operations would be better than existing, but LOS E for some roundabout movements
- Adds green space and bike lanes

Option 3 drawbacks:

- High costs exceeding $1.5-$2 million to implement
- Requires all traffic using the interchange to slow down and traverse the interchange area at 20 mph.
- Waltham Street at Hayden Avenue roundabout may need a multi-lane treatment to operate without congestion during the AM peak hour

- Operations of through movements will be slower than with Option 2
- Potential confusion for Route 2 westbound motorists accessing Waltham Street south as to which exit they should take. It is assumed that the Hayden Avenue off-ramp would remain the signed exit for Waltham Street south.

2.3.4 Area 4 - Concord Avenue at Pleasant and Walnut Streets

Concord Avenue is free flowing across the closely-spaced Pleasant and Walnut Streets intersections. Peak period congestion exists on the approaches of both Walnut and Pleasant Streets to Concord Avenue, although Pleasant Street carries more traffic than Walnut Street. The steep 11-12% downslope of Walnut Street at Concord Avenue coupled with the raised median produces skidding crash related issues during periods when the Walnut Street pavement becomes icy or snowy. Residents noted the absence of a sidewalk on Walnut Street should be addressed, as people do walk down to Concord Avenue from the MWRA water tower park area to the southwest. The layout of Walnut Street appears to be sufficient to permit the addition of a sidewalk on its west side, as it its layout varies from 7-9 feet to the west of the edge of pavement, according to the Lexington GIS files. Restricted to using the pavement at present, pedestrians are competing with motorists in a relatively narrow environment.

Figures 2.34 - 2.37 are photos of the two intersections of Concord Avenue with Walnut Street. Figure 2.38 illustrates potential options for improving the two intersections. Improvement options at both locations are rather limited.

For the Walnut Street approach to Concord Avenue, consideration should be given to:

- Increasing the friction of the Walnut Street approach by paving with a larger aggregate (i.e., 'popcorn' pavement).
- Consider reducing the height of the hedge and width on the west side of Concord Avenue.
- Consider creating a maximum 4' raised sidewalk on Walnut Street between the Beaver Brook Conservation Land and Concord Avenue. This would involve taking of a few large trees and some steep vertical grades so its environmental impact must be carefully weighed. If environmental considerations make it only possible to create a corner sidewalk landing is created on the west side of Walnut Street at Concord Avenue, consider providing a crosswalk on the west side of the intersection if crosswalk warrants are met.

Unlike Walnut Street, the intersection of Pleasant Street with Concord Avenue meets minimum motor vehicle peak hour volume warrants for signalization. The recent history of crashes indicates that its crash rate is lower than the statewide and District 4 rate for similar unsignalized intersections.

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Figure 2.37

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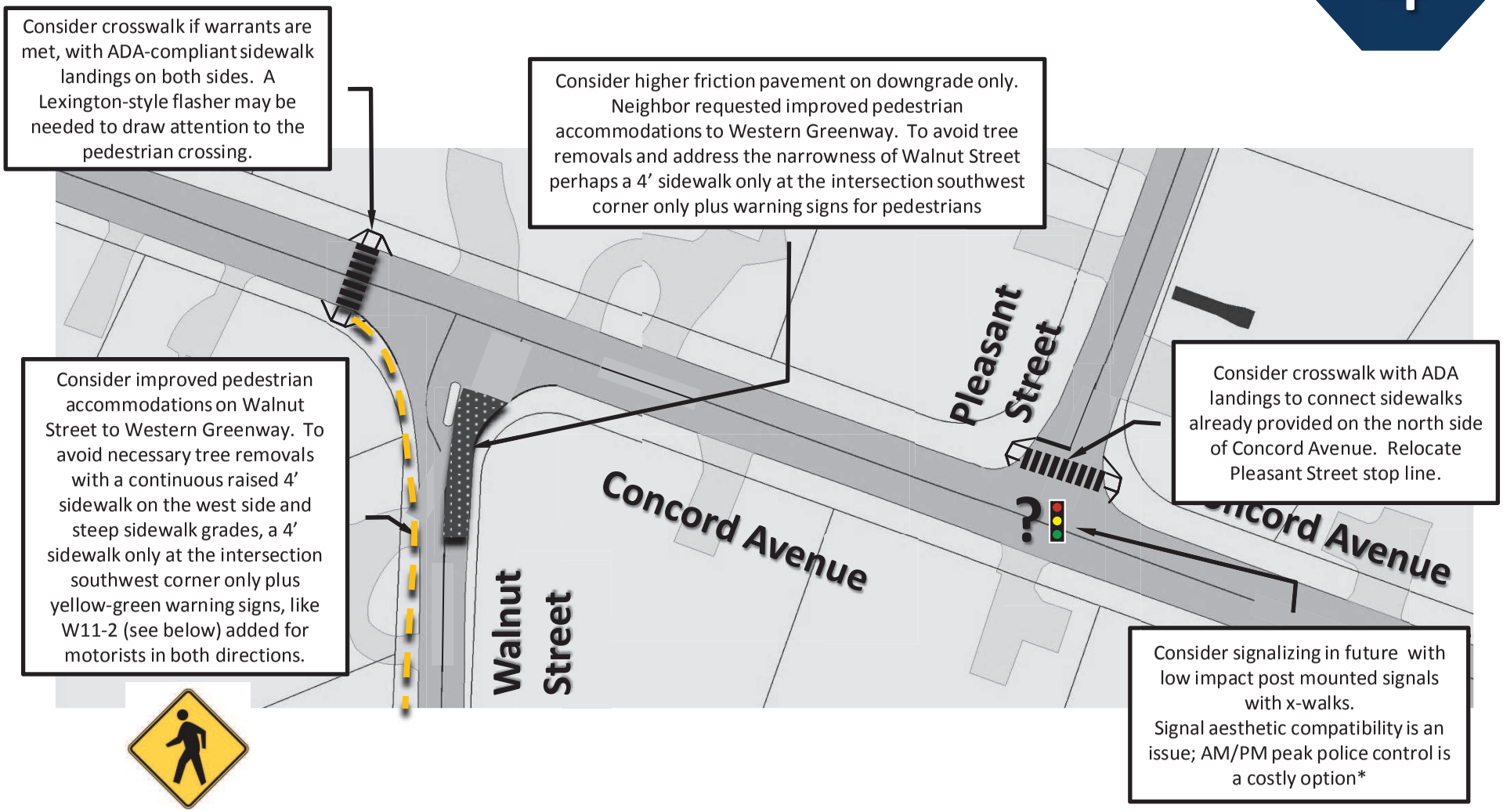

Not to Scale

Base Map: Town of Lexington GIS

* Signalization may help reduce congestion on Pleasant Street, but will increase delays on Concord Avenue and may increase rear end collisions. A signal at this intersection also does not fit well into the tight residential neighborhood environment, so it should only be considered as a last resort, and only if the future crash rate at the intersection increases due to increasing approach demands on Pleasant Street. A crosswalk at the Pleasant Street approach with Concord Avenue with ADA-compliant landings should be considered in any event.

2.3.5 Area 5 - Lincoln at Middle Streets

Stop-controlled at intersection with Lincoln Street, Middle Street is set back from the intersection which has a large expanse of pavement for potential conflict points. Though only a few crashes have been reported at this intersection is has a statistically high crash rate, as relatively few motorists traverse the intersection on a typical weekday. We estimate

Figures 2.39 - 2.41 are photos of the intersection of Lincoln at Middle Streets. Figures 2.42 and 2.44 are optional reconfiguration strategies for the intersection. All options reduce pavement at the intersection and aid in clarifying its turning movements.

Option 1 – Alter alignment – Relocate Middle Street Stop Control to Lincoln Street

Option 1 benefits:

- Should enhance safety compared to 'Do-Nothing' option
- Creates a slow point on Lincoln Street that could reduce the attractiveness of short cutting via Lincoln Street
- Adds green space to the northwest corner of the intersection and could include sharrows on Lincoln Street to increase bike use/driver awareness
- Overall peak hour operations would still be LOS A or better
- Eliminates a stop on Middle Street

Option1 drawbacks:

- Costs roughly $60,000-$80,000 to realign
- Creates a kink in Lincoln Street; loss of continuity, as it would convert southbound through movements to right turns and northbound through movements to left turns.

Option 2 – Realign and Retain Lincoln Street Continuity.

Option 2 benefits:

- Should enhance safety compared to 'Do-Nothing' option
- Provides better sight lines for traffic turning left or right from Middle Street onto Lincoln Street and reduces pavement and speeds of vehicles traversing the intersection.
- Overall peak hour operations would still be LOS A or better
- Adds green space & could include a sidewalk extension

Option 2 drawbacks:

- Costs roughly $70,000-$80,000 to realign with added green space

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Figure 2.39

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Figure 2.40

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Figure 2.41

Lincoln at Middle Streets – T to Middle Street

5

Base Map: Town of Lexington GIS

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Figure 2.42 – Lincoln at Middle Streets

Option 1 – Alter Alignment – Relocate Middle Street Stop Control to Lincoln Street

Lincoln at Middle Streets – T to Lincoln Street

5

Base Map: Town of Lexington GIS

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Figure 2.43 – Lincoln at Middle Streets
Option 2 – Re-align and Retain Lincoln Street Continuity

2.3.6 Other Strategies

It is evident that additional development will occur in the South Lexington area as referenced by the areas permitted or approved, but yet to be built out. This does not include any potential change in use, re-zoning or expansions of existing uses that are not currently in the planning process. Additional growth improves the economic vitality of the Town, but if managed properly can be a successful asset to the community. While economic downturns traditionally occur and many times cannot be predicted the downturn presents an opportunity for communities to re-evaluate future mitigation and infrastructure improvements as well as Town policies on development. An example is the new signalization along Spring Street that was initially studied and discussed in the 1980's and recently implemented.

Typically more growth means additional traffic but if mechanisms are in place to encourage multi-modalism such as adopting MassDOT Complete Streets policies on roadway and intersection projects, providing clear, concise mitigation for development projects and strictly enforcing transportation demand measures (TDM) and other strategies. Some of these are discussed below and further details can be found on the MPO website.

Emphasize and Maximize Site TDM Measures

As the Hayden Avenue and Spring Street area develops, encourage existing site users and members of the 128 Business Council to continue the strong promotion of Travel Demand Management measures. These measures should be reviewed in detail for effectiveness on a before/on-going and after basis and provide the Town with updates or progress reports of the operating system. At a minimum, these measures include:

- Flextime
- Initiate an on-site transportation coordinator
- Employee discounts and promotions of the private shuttle bus services in the area and the Lexpress Service.
- Bicycle parking/storage facilities
- Carpooling/vanpooling

New pedestrian or bicycle accommodations where missing

Care must be taken to address sight line issues and minimum crosswalk warrants established by the national FHWA study "Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations", Final

Report and Recommended Guidelines FHWA Pub No. HRT-04-100, September 2005 (ref: Table 11, P. 54).

Marrett Road (State Route 2A)

Consider installation of 3-4 foot shoulders, with 11-foot lanes and sharrows in the travel lanes in accordance with MUTCD spacing guidelines, typically between the interchange with I-95 and Waltham Street.

Waltham Street

Consider installation of sharrows and 11-foot travel lanes between Marrett Road and the Waltham City line except at the interchange where bike lanes would be appropriate along straight sections of the interchange with buffers of a few feet, if possible.

Optimize and maintain signals regularly

Signal maintenance should be performed routinely, in accordance with the manufacturer's recommendations, with new timing plans as appropriate to ensure all modes using signalized intersections are accommodated as safely and efficiently as possible.

Evaluate the Effectiveness of Shade Street Traffic Calming Strategies

Following a completed study evaluating various traffic calming measures for Shade Street[3], the Town recently repaved and implemented Shade Street traffic calming measures. At the October 2013 public meeting, several Shade Street residents indicated there is a need for further investigation of Shade Street calming measures. We conclude it is important for the Town to test the effectiveness of measures recently implemented *before* it embarks on an alternate traffic calming strategy for Shade Street. Implemented measures include sharrows, edge lines, and with selectively-placed dynamic speed signs to improve the definition of the pedestrian walking environment. Records of post-implementation speeds and before/after crashes should be reviewed to see if it is necessary to consider adjustments to the implemented measures.

We further understand that Shade Street abutters are canvassing neighbors to obtain feedback on the range of appropriate and/or acceptable traffic calming measures that should be considered for Shade Street. This level

[3] *"Potential Traffic Calming Treatments – Shade Street Traffic Calming Study Memorandum",* FST, March 7, 2012

of neighborhood involvement is a good strategy moving forward simultaneously with evaluation of the traffic calming measures already in place. In the event desired speed or through traffic reductions are not achieved, the neighborhood data will be useful in identifying alternate supplemental measures that might be considered.